Location Choice and Risk Aversion

1. Introduction

In a stochastic environment, a firm's degree of risk aversion may reflect the attitude of the firm's management, their assessment of the stockholders' preferences, etc. There have been many studies exploring the implications of changes in the degree of risk aversion on a firm's production decisions in a non-spatial context (see, for example, Baron, 1970; Blair, 1974; Diamond and Stiglitz, 1974; Pope and Kramer, 1979; Macminn and Holtmann, 1983; and Hiebert, 1983, 1992). Yet, there is a vacuum in research examining the impact of a change in risk aversion on a firm's production/location decisions in the spatial context. Martinich and Hurter (1982), as far as we know, is the only attempt in the literature.

In their ingenious work, Martinich and Hurter (1982) examines the effects of changes in risk aversion, uncertainty, and production structure on the firm's optimal solutions in detail. More pointedly, it is the first paper in the literature on the location theory of a firm under uncertainty which allows for general risk preferences by assuming that the firm's risk preferences can be represented by a von-Neumann Morgenstern utility function. In addition, the effect of incremental differences in risk aversion on the firm's location choice has been first established, rather than simply comparing risk-averse with risk-neutral or risk prone firms. One of their major conclusions is that, in a world with input/output price uncertainty, the choice of plant location is invariant with any change in the firm's degree of risk aversion (Martinich and Hurter, 1982, Theorem 10).

Martinich and Hurter (1982) considered two optimization problems. The first, referred to as the 'design-location' problem, takes the rate of output as given and fixed. The second problem, referred to as the 'production-location' problem, includes the rate of output among the variables whose values are to be determined by the firm. The location invariance result for the former problem has been established as Theorem 4 in Martinich and Hurter (1982), while Theorem 10 is the result for the second problem. Since the 'design-location' problem is a constrained 'production-location' problem, the focus of this paper is on the latter only.}

While our understanding about the spatial consequences of a change in risk aversion has been much enriched by Martinich and Hurter (1982), there are two assumptions stipulated by them render their findings rather restrictive. One is (MHI) the firm's utility function is of a

constant absolute risk aversion form, and the other, (MH2) the production function is linear homogeneous.

The purpose of this paper is to provide a general comparative static analysis on a firm's location choice in response to a change in the degree of risk aversion under various types of uncertanty. The analysis is general in the sense that very general specifications of the production and utility functions are adopted. Moreover, in addition to demand/input price uncertainty, we consider also the case where the production technology is random. It will show that some of our results are new and some are generalizations of those obtained by Martinich and Hurter (1982).

The paper is organized as follows. In Section 2 we first set up the model and derive the optimal production and location conditions. In section 3 we examine the effect of changes in the degree of risk aversion on the firm's choice of plant location. Section 4 summarizes our findings.

2. The Main Results

Proposition 1. *Assume a world with demand/input price uncertainty. The firm's choice of plant location is invariant with any change in the degree of risk aversion if the production functions is linear homogeneous.*

Proposition 2. *Assume a world where only the demand price is random. The firm's choice of plant location will be farther away from (nearer to) the output market in response to an increase in the degree of risk aversion if the production function is homogenous of degree is greater (smaller) than one*.

Proposition 3. *Assume a world with technology uncertainty. A firm's choice of plantlocation will be farther away from the output market in response to an increase in thedegree of risk aversion if both inputs are both risk-neutral.*

It is worthy pointing out that Proposition 1 generalizes the invariance result obtained by Martinich and Hurter (1982, Theorem 10) in the sense that we arrive at the same result without the assumption MH1 stipulated by them, and Propositions 2 and 3 are new in the literature.

3. Conclusion

This paper attempts to provide a general comparative static analysis on the firm's choice of production location with regard to a change in the firm's degree of risk aversion under demand price, input price, and technology uncertainties. Our analysis shows that whether and how the plant location varies with a change in the firm's degree of risk aversion depend upon the nature of the production technology and how the input and location choice affect risk. The following location invariance result has been established: In a world where only the demand/input prices are random, the firm's degree of risk aversion has no impact on its location decision if the production function is linear homogeneous (Proposition 1). In addition, we provide some unambiguous effects regarding the firm's locational response while the firm's choice of plant location is not invariant with respect to a change in the firm's degree of risk aversion (Propositions 2 and 3). These results are either new or generalizations to those obtained by Martinich and Hurter (1982).

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